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FIRE SEASON SEVERITY IN 1955 ON THE KLAMATH NATIONAL FOREST

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Forest fires in 1955 burned over more land in northern California than in any other fire season in recent history. Much of this area was burned in two weeks of extremely severe fireweather in late August and early September. During this time, the Haystack fire alone swept over more than 64,000 acres on the Klamath National Forest. What were the burning conditions that led to the disastrous Haystack and other large fires of this period? Analysis of the daily fire danger on the Klamath National Forest shows that the extreme conditions in early fall climaxed a fire season already marked by unusually severe burning conditions.

Measurement of Burning Conditions

Fire danger ratings compiled daily on the national forests of California[1] can be used as a measure of burning conditions. These numerical ratings are proportional to the forward rate of spread of fire for observed conditions of wind velocity, temperature, humidity, and moisture content of fine fuels. In fuel types where large-sized fuels are important, the rating is adjusted to include the effect of the moisture content of these fuels on rate of spread and fire intensity. Thus in timbered areas, such as most of the Klamath National Forest, both the daily fire weather and moisture content of large fuels must be considered in evaluating the severity of burning conditions.

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[1] U.S. Forest Service, California Region. Fire Danger Rating, 11 pp. plus appendix. 1955.

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Daily Fire Danger

As a measure of the severity of the daily fire weather in different years, the fire danger ratings before adjustment for moisture content of large fuel were cumulated for July, August, and September. The totals (table 1), show that the daily fire danger in 1955 ranked near or at the top in all of the timbered areas. In contrast, the fire season of 1948--generally considered an "easy" fire year--ranked near or at the bottom for all areas.

Table 1.--Cumulated fire-danger ratings for rating areas on the Klamath National Forest, 1945-1955

Year	Fire-danger rating area and station						
	Area 1 Yreka	Area 2 Fort Jones	Area 3 Happy Camp	Area 4 Sawyers Bar	Area 5 Callahan	Area 6 Happy Camp	Area 7 Mt. Hebron
1945	-	3,256	2,885	2,925	2,634	2,885	1,031
1946	2,409	2,734	2,394	2,672	2,348	2,394	1,112
1947	2,813	2,835	2,264	2,591	2,074	2,264	1,075
1948	2,366	2,493	2,442	2,248	2,235	2,442	942
1949	2,846	2,849	2,829	2,649	2,336	2,849	1,181
1950	2,754	2,804	2,881	2,863	2,798	2,804	1,018
1951	3,010	2,823	2,989	3,213	3,081	2,823	1,153
1952	2,693	2,746	3,043	2,771	2,775	2,746	1,033
1953	2,604	2,633	2,430	2,943	2,579	2,633	992
1954	2,639	2,707	2,611	2,644	2,442	2,707	1,148
1955	3,053	2,988	2,861	3,070	2,562	2,988	1,113

Note: Areas 1 to 6 are classified as timber fuel types. Area 7 is a grass fuel type.

Moisture Content of Large Fuels

The moisture content of the large fuels at any time during the fire season depends upon the amount of moisture in the fuels at the beginning of the season and the amount they have dried during the season. In the danger rating system, these conditions are expressed by two indexes. One is a "precipitation index" derived from the amount of precipitation received at selected stations during the winter and spring months. This index is used as a measure of the moisture content of the large fuels at the beginning of the fire season. A high precipitation index indicates wet fuels and a low index indicates relatively dry fuels. The other index is a "drying index" computed from the deviations in moisture content of fuel-moisture indicator-sticks. Large plus values indicate poor drying conditions, with the large fuels drying slowly from their starting moisture content. Large negative values indicate good drying conditions resulting in rapid drying of the large fuels.

In timbered areas, the character of the fire season is closely associated with these indexes. In the easy fire year of 1948, for example, the precipitation index for the Yreka area was moderately high, and the drying index reached its highest plus value for the 1945-1955 period (fig. 1). Large fuels in this year, then, started the season at a high moisture content and dried slowly so that moisture content of these fuels remained relatively high throughout the entire season. In contrast, the precipitation index in 1949 was low and the drying index reached a large negative value. Thus large fuels started the season relatively dry and dried more than usual during the summer. The effect of the low moisture content of large fuels on fire behavior was partly responsible for the 1949 season being considered one of the most difficult of recent years.

In 1955, both the precipitation index and drying index were at the minimum for the 11-year period. This indicates that the large fuels started the season with exceptionally low moisture content and become abnormally dry during the season. Such conditions would lead to extremely hot-burning and rapid-spreading fires.

Fire Season Severity

How the average number and size of fires vary with the fire danger rating has been determined for northern California.[2] By combining these relationships a "potential" for burned area can be computed for any level of fire danger. If this potential is computed for each day's level of fire danger in a locality, the sum of these daily potentials provides a good measure of the burning conditions that have existed over the fire season, and relative severity of fire seasons can be determined by comparing seasonal totals.

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[2] Countryman, C.M., and Intorf, P.H. A Fire Season Severity Index for California. California Forest and Range Expt. Sta. Misc. Paper 14. 7 pp. 1953.

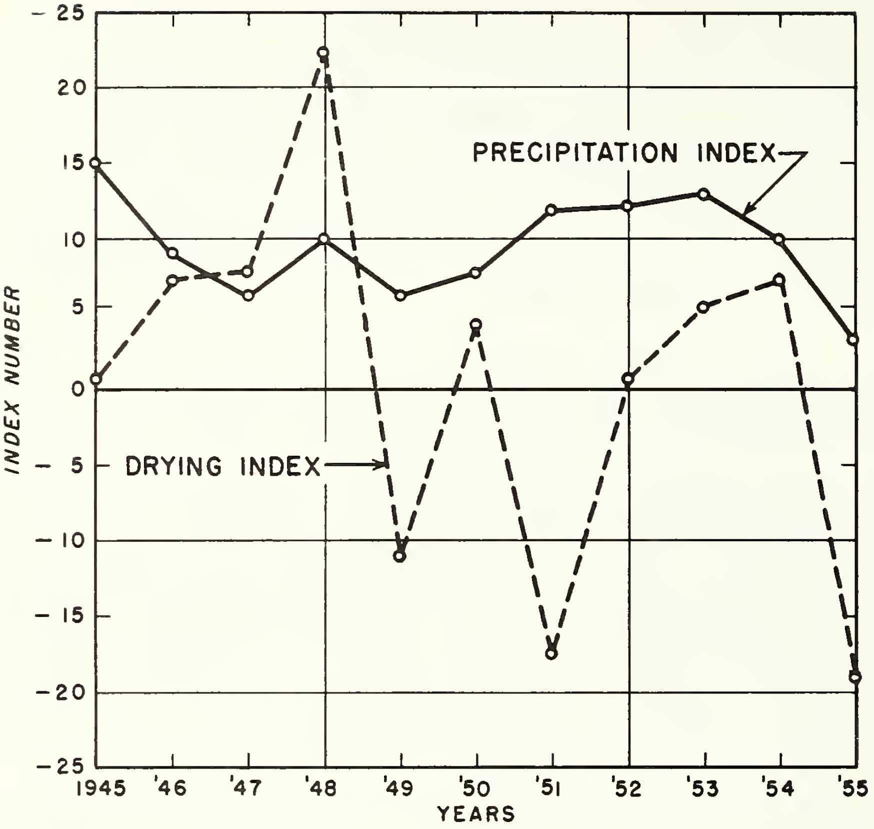

Figure 1.--Precipitation and drying index for fire danger rating Area 1 (Yreka), Klamath National Forest, 1945-1955.

Fire season[3] potentials were computed for one fireweather station in each of the fire-danger rating areas on the Klamath Forest for the years 1945 to 1955. To give a uniform base for comparison, an average seasonal potential was computed for each area by assuming that the mean fire danger occurred every day. The ratio of the total for each season to this average seasonal total was used as a "fire season severity index".

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[3] July, August, and September only.

In all of the timbered areas, the severity indexes showed the 1955 season to be the worst of the 11-year period (table 2). For example, the 1955 season at Yreka with an index of 2.95 was more than 1.7 times as severe as the previous high year of 1949 and nearly 4.5 times as severe as the easy year of 1948.

Table 2.--Fire season severity indices for fire danger rating areas on the Klamath National Forest, 1945-1955

	Fire-danger rating area and station						
Year	Area 1 Yreka	Area 2 Fort Jones	Area 3 Happy Camp	Area 4 Sawyers Bar	Area 5 Callahan	Area 6 Happy Camp	Area 7 Mt. Hebron
1945	--	1.95	0.94	1.15	1.32	0.79	1.47
1946	0.70	1.43	0.74	1.13	1.00	0.58	1.76
1947	1.35	1.32	0.49	0.97	0.58	0.45	1.32
1948	0.67	0.84	0.78	0.57	0.81	0.41	1.16
1949	1.72	1.51	1.91	1.49	1.07	1.44	1.63
1950	1.32	1.40	1.21	1.13	1.34	1.00	1.13
1951	1.30	1.33	1.88	1.86	2.05	1.54	1.46
1952	0.76	0.97	1.09	0.87	1.29	0.96	1.15
1953	0.65	0.86	0.68	0.78	1.01	0.59	1.01
1954	1.10	1.11	0.73	0.79	1.24	0.71	1.64
1955	2.95	3.31	2.24	3.10	2.08	1.83	1.53

Note: Areas 1 to 6 are classified as timber fuel types. Area 7 is a grass fuel type.

Most of the area burned on the Klamath National Forest in 1955 resulted from fires during the unusually severe fire weather in late August and early September. However, this extreme period was only partly responsible for the year's high severity index. Cumulative severity indices computed by 5-day periods for the Yreka area (fig. 2) show that by August 25 the severity index already exceeded that for the entire season of 1949, the worst previous year. As early as July 27, 1955, the cumulative index had equaled that for the entire 1948 season. Even then, the extreme fire weather in late August and early September increased the severity index materially, as is shown in figure 2 by the sharp increase in slope of the 1955 curve during this period.

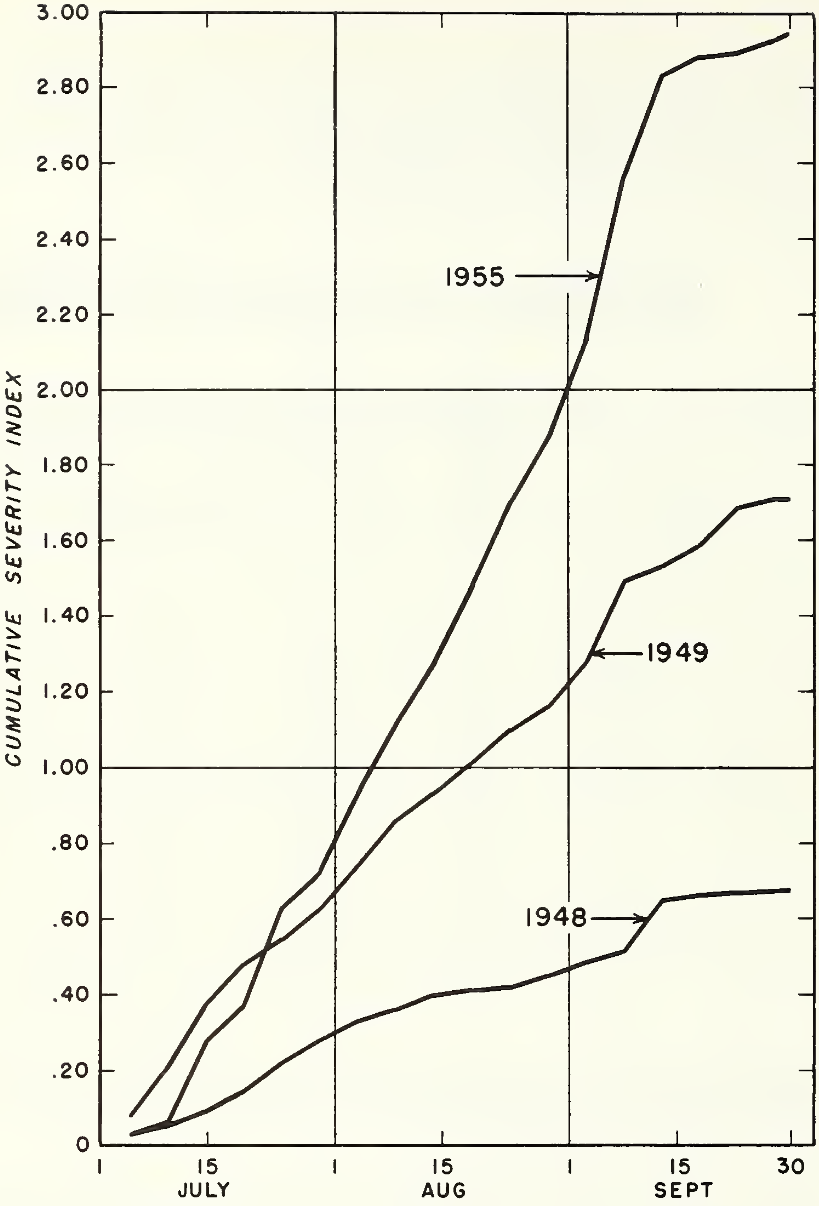

Figure 2.--Cumulative severity index by 5-day periods for Area 1 of the Klamath National Forest.

The severity of the 1955 fire season appears to be the result of abnormally low winter and spring precipitation, a favorable season for drying of large fuels, and severe fire weather--all occurring in the same year. Yet, a more severe season is possible. The precipitation index in the Yreka area for example, was 3.4 in 1955. Lower indexes occurred in 1924 (1.7) and in 1926 (3.0). A precipitation index of 1.7 in 1955 with all other conditions being the same would have resulted in a severity index of 4.46 instead of 2.95. Lower drying indices than that for 1955 are possible, and daily fire weather has been more severe in some fire danger rating areas. New extremes of these factors occurring simultaneously would result in an even greater potential for a disastrous fire year.